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TRANSLATION

MEDICAL INVESTIGATIONS IN EASTERN ANTARCTIC

By

N. R. Pabyev

FOREIGN TECHNOLOGY DIVISION

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UNEDITED ROUGH DRAFT TRANSLATION

MEDICAL [illegible] IN [illegible] ANTARCTIC

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MEDICAL INVESTIGATIONS IN EASTERN ANTARCTIC

By

N. R. Paleyev

Physiological investigations were made by us from December, 1955, through March, 1957, til January 1956, at the time for travelling to the Antarctic on board the Diesel-Meter ship "LENA," from May, 1956, through February, 1957, at Mirayy, in February and March of 1957 on the return trip on board the steam ship "KOOPERATSIYA" travelling from the Antarctic to the USSR. In April and May of 1956, according to the program developed by the author, a number of medical observations were made among the participants of the sled-tractor expedition travelling into the depth of the Antarctic continent, and then at the PIONERS KAYA station by aerologist, V. K. Babarykin. Physiological investigations were intended to study man's acclimatization in the Antarctic.

The purpose of the ob rvations was to explain the following problems: 1) Does the human organi ience any changes under conditions of long-lasting work in the An what kind of change: 2) Are such changes dangerous to normal vital. of the organism: 3) What factors do cause the changes: 4) How rapidly do these changes develop and for how long are they preserved after leaving the Antarctic (how long do the physiological or pathophysiological changes last): 5) Do such displacement develop in the human organism under conditions of travelling in the tropics.

On the basis of collected data, we intended on making a comparative analysis of the process of acclimatizing in Central Arctic and in the Antarctic. In case of revealing pathological displacements in the state of health of winter inhabitants of forts were to be made to develop measured which would neutralize these displacements.

Observations on the Diesel-motor ship, LENA

Observations were conducted from December 16, 1955, through January 14, 1956. To become thoroughly acquainted with the state of health of the future winters prior to their arrival at the Antarctic and to reveal the effect of the tropical climate on the organism of a person not adapted to it, we selected a group of expedition participants consisting of 13 men in the age of 22 to 52 years. The observed were subjected to therapeutic examinations, thermometry and blood pressure measurements. A total of 54 such observations were made.

During therapeutic investigations and thermometry, no substantial changes were discovered in the state of health of the tropics among 13 of the 13 investigated (table 1). Four of five investigated with almost no-change in blood pressure level, were people of over 40 years. Within 8-12 days after the LENA left the tropical zone a majority of the observed with reduced blood pressure showed a tendency toward restoration of its level to the initial numbers; young people in age of up to 32 years showed a more clearly expr[illegible] tendency in this respect.

Table 1. Table of blood pressure fluctuations (in mm)

No.	Age (Years)	Initial	Min. level in tropics	Within 8-12 days
1	22	120/80	110/65	115/75
2	24	120/75	110/60	115/70
3	26	120/80	100/70	110/75
4	31	115/80	110/70	110/75
5	32	120/80	105/70	110/75
6	34	110/70	90/65	95/75
7	36	135/85	120/75	120/80
8	37	120/80	105/65	110/65
9	39	125/85	105/65	110/70
10	40	130/95	120/80	120/80
11	46	125/85	105/65	110/70
12	48	125/90	120/80	120/80
13	52	130/85	110/75	110/75

Observations at Mirnyy

The program of investigations at Miravy included: 1) Measuring blood pressure, electro skin resistance, skin temperature and oxygen in blood: 2) studying weight dynamics and seasonal fluctuations of the diurnal periodicity of body temperature: 3) investigation of the respiratory, cardio-vascular, nervous, and other systems of the organism. Further, more radiation of body surface balance was measured.

Four physiological investigations was selected a group of 25 persons. To determine the role of age in the process of acclimation, nature of work activity and length of service under polar conditions, we selected in the group various members of the expedition differing in these symptoms.

The observed were divided by age into three groups: from 20-30 years, six people; from 30-40 years, 10 people; from 40-46 years, nine people. By the nature of work, the group also has three categories: five people did physical work with daily long remaining in open air; eight people doing miscellaneous work of physical work with irregular stay in open air; the work of twelve people was basically of interior nature. Of the 25 observed, ten were experienced polar workers with long experience of staying in the Arctic. Eight people worked in the extreme north for 2-3 years, and seven people, who prior to Mirnyy never worked under polar conditions.

Physiological investigations were made in accordance with the following monthly plan.

On the first week of the month was realized: a) thermometry of the entire group within a period of three days in the order of 9, 6, 9, 12, 15, 18, and 21 hours; b) blood pressure on Monday, Tuesday, and Wednesday three times daily; between 8-9, 12-13, and 22-23 hours, with the morning and evening measurements made in bed; c) examination of the respiratory, cardio-vascular, nervous,

uregenital and alimentary systems of the organism; d) suspension in the morning on empty stomach 1, 2, and 3rd number each month.

During the second week was carried out; a) blood pressure measurement on Mondays, Tuesdays, and Wednesdays, three times daily; b) studying the level of electro skin resistance, oxygen content in the blood in calm state and after physical strain, skin temperature (forehead, back of wrist, back of feet), measuring radiation balance on clothed and undressed person.

On the third week, blood pressure was measured on Monday, Tuesday, and Wednesday, three times daily.

On the fourth week, blood pressure was measured on Monday, Tuesday, and Wednesday, three times daily.

For physiological investigations was used the following apparatus: mercury pressure guage, tonometer, apparatus for measuring electro skin resistance, electrothermometer, oxyhometer, radioneter, Potentiometer PP, thermometers, and scales.

From May, 1956 through February 1957, were made 2295 blood pressure measurements. Electro skin resistance was determined 180 times. Skin temperature was measured 225 times in three points simultaneously. A total of 175 suspensions of investigated was made. Body temperature was measured 1800 times. Oxygen content in the blood was determined 224 times, twice in each case—prior and after strain.

Therapeutic investigation of the observed was executed 198 times. Radiation balance was measured 32 times.

Observations at PIONERSKAYA

From April 4 through May 24, 1956, the aerologist of the expedition V. K. Babarykin after special training made medical examinations on participants of the sled-tractor expedition. To single medical examination is also subjected the crew of the AN-2 aircraft, which flew into PIONERSKAYA. Babarykin made a

total of the investigations. The observation program included the following tasks: a) state of health of the observed, b) state of respiration, c) cardiac activity (sensations in the region of the heart, heart beats, and pulse). d) activity of the alimentary organs, e) sleep, f) fatifue, g) blood pressure (measurements were made with a calibrated tonometer).

Preliminary processing of the material collected by him showed that the blood pressure in the examined dropped by 10-40 mm Hg. Pulse pressure in proportion to the travel of the sled-tractor train into the depth of the continent was reduced to 10-15 mm. Hg. Pulse frequency rose in comparison with the ordinary by 20-50 beats per minute. Quite often in quiescent state, during sleep, came a panting. Even light physical labor caused sharp panting and heart beats. Fatigue was clearly expressed. Quite often, complaints were made of pains in the region of the heart. Almost all participants of the expedition suffered somnolence and headaches. Greater losses in weight were observed, reaching a 10-14 kg. toward the end of the wintering.

Observations on the steamer KOOPERATSIYA

From February 18 through April 2, 1957, the winters were subjected to regular observations; these were the people who were investigated at Mirnyy (with the exception of four persons returning home on board the LENA and OB ships). The investigation program included therapeutic observations, blood pressure, measurements, electro skin resistance measurement, measurement of skin temperature, and radiation balance.

Analysis of obtained data allows to make certain preliminary conclusions.

1. After several months of work in the Antarctic in the human organism develop changes, evidently, of physiological nature.

Among 17 of 25 investigated the blood pressure dropped by 15-25% and reached the lower boundaries of the norm: 100/65 - 80/55 mm Hg; in five persons, the blood pressure dropped by 10 mm; in three, it remained without

stable during all of the remaining time.

In a majority of the investigated, there developed neurasthenic symptoms, expressed in irritability, noncontainment, sleeplessness of somnolence, frequent dreaming, and higher fatigue; in six people, was observed neurosis of the heart. Many often suffered headaches. When working in open air, there was always the development of panting, increase in heart beat frequency. All gained 3-12 kg in weight. On a majority of the investigated was observed an increase in the frequency of urinating. Twenty-five per cent of the investigated developed facial endema.

2. The nature of organismal changes in the observed and their expressions is not identical in each individual case. Most expressed are the displacements in young people doing mostly office work and not having worked previously at the extreme north; least expressed among people of middle age (30-40 years) doing physical labor and having worked for a long time in the extreme north.

3. Disorders in the vitality of the organism of expedition participants were caused by the effect of the Antarctic climate (reverse seasonality of the year), constant low temperature, low level of atmospheric pressure on the background of which is always observed extraordinary sharp baric fluctuations, by the rarefaction of the air and certain oxygen connected with it, strong winds, low relative atmospheric humidity (in living quarters, humidity varies from 25 to 40%) and effect of solar radiation with a rise in the content of ultraviolet rays, long polar twilights, and psychological effect of being separated from accustomed conditions.

4. The status of the participants of the sled-tractor train and of the newly created PIONERSKAYA station is in many aspects identical to mountain sickness. An analogous state in mountains of average latitudes develops at a height considerably exceeding the elevation at which the PIONERSKAYA is situated

(2,700 m).

5. Mirnyy observations have shown that maximum time of productive work in the Antarctic does not exceed 1 - 1.5 years.

6. When voyaging in the tropical zone, it was noticed a rapid drop in blood pressure among a predominant majority of the investigated down to the low boundary of the norm. This decrease develops faster and is deeper among young people, but the restoration of the blood level is also faster among young people than among people of middle age.

Studying the heat protecting properties of clothing.

Such investigations were made by the author and meterologist N. P. Rusin at Mirnyy from August 30 through September 13, 1956, in accordance with a method developed by them. The following are sets of clothing that were subjected to examination; set A- linen, cloth jacket, down suit, foot-cloth, valenki (type of felt boots), fur mittens; set B- linen, sweater, leather suit, furred jacked wool spouts, valenki, and fur mittens.

Experiments were made with the aid of a constant meteorological electro-thermometer with 17 feelers. Seven feelers were used for the testing of the clothing; they were arranged on the surface of the skin under the clothing in following points; on the chest, back, abdomen, small of the back, wrist, forward part of the hip. The seventh feeler was placed in a compartment at room temperature. That is where the recording part of the instrument was placed.

Temperature readings were made every 5-10 minutes. Before each measurement was made a control temperature measurement of the surface of the body in the room under conventional clothing. After the clothing was tested in the open air, the experiments continued in a compartment until control temperature was restored. In tables 2 and 3 is given a protocol of the clothing tests A and B (room temperature 19°.5).

Table 2. Protocol on testing clothing of set A.

Placing of feelers	Temperature						
	cont. in room	in open air within					
		10 m.	15 m.	20 m.	25 m.	30 m.	40 m.
Chest	30°7	20°4	14°9	14°9	13°4	12°9	14°7
Back	33,3	26,2	25,8	24,4	25,2	26,5	20,9
Abdomen	34,6	32,1	31,3	30,0	29,4	28,6	27,4
Small of back	32,5	31,3	30,9	30,9	29,8	29,4	28,6
Wrist	33,4	20,4	14,5	11,3	9,[illegible]	8,8	7,[illegible]
Hip	31,0	21,6	18,2	16,8	16,6	17,6	12,3

m. = minute.

Because of severe cooling, the experiment was disrupted.

Placing of feelers	Temperature					
	cont. in room	in open air within				
		10 m.	20 m.	25 m.	30 m.	40 m.
Chest	29°9	24,7	9°3	9°6	9°2	9°0
Back	33,0	28,6	8,6	8,6	8,3	8,0
Abdomen	34,2	33,8	9,7	9,7	9,3	9,0
Small of back	33,6	32,3	9,5	9,5	9,1	8,6
Hip	30,9	19,2	9,5	9,5	8,9	8,4
Wrist	31,9	18,1	9,1	9,1	8,7	8,5

m. = minute

Experiments were carried out in the open air under the following meteorological conditions:

A: wind velocity 15-20 m/sec, temperature- 18°.5
B: wind velocity 18-26 m/sec, temperature- 26°

After the tested person returned into the room, the temperature rose to control numbers within approximately 40 minutes.

Five minutes after beginning the experiment, the wind was already directed against the back, producing an unpleasant sensation of cold. Within 10 minutes the wind gusts pierced through the down suit (set A) in any give point, and the places adhering to the side section of the pants became frozen. Within approximately 20 minutes, it became very cold; slight shivering began. After the wind gusts subsided, it became a bit warmer. The completion of the experiment was accompanied by a sharp chill. Experiments showed that the suit is easily penetrable by the wind, and can be used either in windless weather or in combination with a storm suit. Unfortunately no such tests were made with the storm suit.

Table 3 shows convincingly the deficiency of the heat protective properties of the clothing belonging to set B under conditions of frosty, stormy weather (rapid drop of skin temperature)

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